This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below and choose the interval the simplification is contained within.

$$9 - 1 \div 10 * 11 - (20 * 4)$$

The solution is -72.100, which is option B.

A. $[85.3, 89.7]$

88.991, which corresponds to not distributing addition and subtraction correctly.

B. $[-72.5, -71.4]$

* -72.100, which is the correct option.

C. $[-71.1, -69.5]$

-71.009, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[-49.3, -47.3]$

-48.400, which corresponds to not distributing a negative correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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2. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{8}{0} + \sqrt{80}i$$

The solution is Not a Complex Number, which is option B.

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

B. Not a Complex Number

* This is the correct option!

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-45 - 11i}{8 + 4i}$$

The solution is $-5.05 + 1.15i$, which is option E.

A. $a \in [-4.5, -3.5]$ and $b \in [-3.5, -2.9]$

$-3.95 - 3.35i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

B. $a \in [-7, -5.5]$ and $b \in [-3.2, -2.7]$

$-5.62 - 2.75i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-405.5, -403.5]$ and $b \in [0.9, 1.6]$

$-404.00 + 1.15i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

D. $a \in [-5.5, -4]$ and $b \in [91.45, 92.9]$

$-5.05 + 92.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [-5.5, -4]$ and $b \in [0.9, 1.6]$

* $-5.05 + 1.15i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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4. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{22}{0}}$$

The solution is Not a Real number, which is option D.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Irrational

These cannot be written as a fraction of Integers.

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Not a Real number

* This is the correct option!

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{\frac{22}{0}}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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5. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 3^2 + 19 \div 15 * 17 \div 16$$

The solution is -6.654, which is option C.

A. $[9.55, 10.63]$

10.005, which corresponds to two Order of Operations errors.

B. $[10.15, 13.6]$

11.346, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[-7.07, -6.63]$

* -6.654, this is the correct option

D. $[-9.06, -7.76]$

-7.995, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(6 - 5i)(-7 - 10i)$$

The solution is $-92 - 25i$, which is option A.

A. $a \in [-98, -89]$ and $b \in [-25, -21]$

* $-92 - 25i$, which is the correct option.

B. $a \in [-44, -40]$ and $b \in [43, 53]$

$-42 + 50i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-98, -89]$ and $b \in [23, 28]$

$-92 + 25i$, which corresponds to adding a minus sign in both terms.

D. $a \in [7, 11]$ and $b \in [-95, -92]$

$8 - 95i$, which corresponds to adding a minus sign in the first term.

E. $a \in [7, 11]$ and $b \in [88, 96]$

$8 + 95i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(5 - 8i)(-4 + 2i)$$

The solution is $-4 + 42i$, which is option B.

A. $a \in [-42, -31]$ and $b \in [-23, -21]$

$-36 - 22i$, which corresponds to adding a minus sign in the first term.

B. $a \in [-6, -2]$ and $b \in [37, 48]$

* $-4 + 42i$, which is the correct option.

C. $a \in [-42, -31]$ and $b \in [21, 25]$

$-36 + 22i$, which corresponds to adding a minus sign in the second term.

D. $a \in [-22, -19]$ and $b \in [-21, -14]$

$-20 - 16i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-6, -2]$ and $b \in [-47, -35]$

$-4 - 42i$, which corresponds to adding a minus sign in both terms.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{2574}{13}}$$

The solution is Irrational, which is option C.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

C. Irrational

* This is the correct option!

D. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

E. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\sqrt{198}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-1430}{10}} + \sqrt{154}$$

The solution is Nonreal Complex, which is option E.

A. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

B. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

C. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

D. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

E. Nonreal Complex

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{36 + 33i}{-2 + 6i}$$

The solution is $3.15 - 7.05i$, which is option E.

A. $a \in [2.5, 4]$ and $b \in [-282.5, -281]$

$3.15 - 282.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [-19, -17.5]$ and $b \in [5, 6.5]$

$-18.00 + 5.50i$, which corresponds to just dividing the first term by the first term and the second by the second.

C. $a \in [-7, -6]$ and $b \in [3, 4.5]$

$-6.75 + 3.75i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [125, 127]$ and $b \in [-8, -6.5]$

$126.00 - 7.05i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [2.5, 4]$ and $b \in [-8, -6.5]$

* $3.15 - 7.05i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.
